WE CLAIM:

1. An autonomous cell balancing system, comprising:

a battery including a first cell and a second cell;

a first bi-directional cell balancing converter and a second bi-directional cell balancing converter, said first cell balancing converter being connected with said first cell of said battery and said second cell balancing converter being connected with said second cell of said battery; and

a common share bus, said common share bus being connected with said first cell balancing converter and with said second cell balancing converter; and

a first drive input and a second drive input, said first drive input being connected with said first cell balancing converter and said second cell balancing converter, and said second drive input being connected with said first cell balancing converter and said second cell balancing converter.

2. The autonomous cell balancing system of claim 1, further comprising at least one additional cell of said battery and at least one additional bi-directional cell balancing converter, wherein the total number of said cells of said battery is equal to the total number of said bi-directional cell balancing converters.

3. The autonomous cell balancing system of claim 1, wherein said battery comprises a lithium-ion battery.

4. The autonomous cell balancing system of claim 1, wherein said first bi-directional cell balancing converter and said second bi-directional cell balancing converter comprise a push-pull DC-DC converter.

5. The autonomous cell balancing system of claim 1, wherein said

first bi-directional cell balancing converter and said second bi-directional cell balancing converter comprise a single ended DC-DC converter.

6. The autonomous cell balancing system of claim 1, wherein said first bi-directional cell balancing converter and said second bi-directional cell balancing converter comprise a combined DC-DC/flyback converter.

7. The autonomous cell balancing system of claim 1, further comprising;

a first AND gate and a second AND gate, wherein said first cell balancing converter is connected with said first drive input via said first AND gate, and wherein said first cell balancing converter is connected with said second drive input via said second AND gate;

a third AND gate and a fourth AND gate, wherein said second cell balancing converter is connected with said first drive input via said third AND gate, and wherein said second cell balancing converter is connected with said second drive input via said fourth AND gate;

a first drive enable input, wherein said first drive enable input is connected with said first AND gate and said second AND gate; and

a second drive enable input, wherein said second drive enable input is connected with said third AND gate and said fourth AND gate.

8. The autonomous cell balancing system of claim 1, wherein said first cell is connected with said first bi-directional cell balancing converter via a fuse for protection against a high fault current due to a component failure.

9. The autonomous cell balancing system of claim 1, wherein said second cell is connected with said second bi-directional cell balancing converter via a fuse for protection against a high fault current due to a component failure.

10. The autonomous cell balancing system of claim 1, wherein said first cell of said battery provides a first cell voltage to said first cell balancing converter and said second cell of said battery provides a second cell voltage to second cell balancing converter.

11. The autonomous cell balancing system of claim 1, wherein said first drive input provides a first drive voltage to said first cell balancing converter and said second cell balancing converter, and wherein said second drive input provides a second drive voltage to said first cell balancing converter and said second cell balancing converter.

12. The autonomous cell balancing system of claim 1, further comprising a first cell telemetry output and a second cell telemetry output, wherein said first cell balancing converter provides a first telemetry output voltage at said first cell telemetry output that is proportional to said first cell voltage, and wherein said second cell balancing converter provides a second telemetry output voltage at said second telemetry output that is proportional to said second cell voltage.

13. The autonomous cell balancing system of claim 1, wherein said battery further includes a plus terminal and a minus terminal, and wherein said plus terminal is connected with a battery charger controller that charges said first cell of said battery to a first cell voltage and said second cell of said battery to a second cell voltage.

14. The autonomous cell balancing system of claim 1, wherein said autonomous cell balancing system is part of an electrical power supply subsystem of a spacecraft.

15. A push-pull DC-DC cell balancing converter, comprising:

a cell plus terminal, a cell minus terminal, and a ground terminal, wherein a cell voltage is applied between said cell plus terminal and said cell minus terminal;

a transformer including a primary winding having a center tap, a first terminal and a second terminal, and a secondary winding having a center tap, a first terminal and a second terminal, wherein said center tap of said primary winding is connected with said cell plus terminal;

a share bus plus terminal, a share bus minus terminal, a share bus resistor, and a share bus fuse, wherein said center tap of said secondary winding is connected with said share bus plus terminal via said share bus resistor and via said share bus fuse;

a first power MOSFET including a gate, wherein said first terminal of said primary winding is connected with said cell minus terminal via said first power MOSFET;

a second power MOSFET including a gate, wherein said second terminal of said primary winding is connected with said cell minus terminal via said second power MOSFET;

a third power MOSFET including a gate, wherein said second terminal of said secondary winding is connected with said ground terminal via said third power MOSFET;

a fourth power MOSFET including a gate, wherein said first terminal of said secondary winding is connected with said ground terminal via said fourth power MOSFET;

a first drive input terminal including a first drive voltage, wherein said first drive voltage is coupled into said gate of said second power MOSFET and into said gate of said fourth power MOSFET; and

a second drive input terminal including a second drive voltage, wherein said second drive voltage is coupled into said gate of said first power MOSFET and into said gate of said third power MOSFET.

16. The push-pull DC-DC cell balancing converter of claim 15, further comprising a first capacitor and a first resistor, wherein said second drive voltage is coupled into said gate of said first power MOSFET via said first capacitor and via said first resistor.

17. The push-pull DC-DC cell balancing converter of claim 15, further comprising a second capacitor and a second resistor, wherein said first drive voltage is coupled into said gate of said second power MOSFET via said second capacitor and via said second resistor.

18. The push-pull DC-DC cell balancing converter of claim 15, further comprising a voltage at said center tap of said secondary winding that is an exact replica of said cell voltage applied between said cell plus terminal and said cell minus terminal.

19. A single ended DC-DC cell balancing converter, comprising:

a cell plus terminal, a cell minus terminal, and a ground terminal, wherein a cell voltage is applied between said cell plus terminal and said cell minus terminal;

a transformer including a primary winding having a first terminal and a second terminal, a first secondary winding having a first terminal and a second terminal, and a second secondary winding having a first terminal and a second terminal, wherein said first terminal of said primary winding is connected with said cell plus terminal;

a share bus plus terminal, a share bus minus terminal, a share bus resistor, and a share bus fuse, wherein said first terminal of said first secondary winding is connected with said share bus plus terminal via said share bus resistor and via said share bus fuse;

a first power MOSFET including a gate, wherein said second terminal of said primary winding is connected with said cell minus terminal via

said first power MOSFET;

a second power MOSFET including a gate, wherein said second terminal of said first secondary winding is connected with said ground terminal via said second power MOSFET;

a small-signal MOSFET including a gate, wherein said second terminal of said second secondary winding is connected with said ground terminal via said small-signal ground terminal;

a first drive input terminal including a first drive voltage, wherein said first drive voltage is coupled into said gate of said first power MOSFET and into said gate of said second power MOSFET;

a second drive input terminal including a second drive voltage, wherein said second drive input is operated as a sample input terminal including a sample voltage, and wherein said sample voltage is coupled into said gate of said small-signal MOSFET; and

a cell telemetry output including a cell telemetry plus terminal and a cell telemetry minus terminal, wherein said first terminal of said second secondary winding is connected with said cell telemetry plus terminal.

20. The single ended DC-DC cell balancing converter of claim 19, further comprising a capacitor and a resistor, wherein said first drive voltage is coupled into said gate of said first power MOSFET via said capacitor and via said resistor.

21. The single ended DC-DC cell balancing converter of claim 19, wherein said sample voltage applied at said second drive input terminal activates a telemetry output voltage between said cell telemetry plus terminal and said cell telemetry minus terminal.

22. The single ended DC-DC cell balancing converter of claim 19, wherein said telemetry output voltage is proportional to said cell voltage applied

between said cell plus terminal and said cell minus terminal.

23. A combined DC-DC/flyback cell balancing converter, comprising:

a cell plus terminal and a cell minus terminal, wherein a cell voltage is applied between said cell plus terminal and said cell minus terminal;

a transformer including a primary winding having a first terminal and a second terminal, a first secondary winding having a first terminal and a second terminal, and a second secondary winding having a first terminal and a second terminal, wherein said first terminal of said primary winding is connected with said cell plus terminal;

a power MOSFET including a gate, wherein said second terminal of said primary winding is connected with said cell minus terminal via said first power MOSFET;

a share bus plus terminal, a share bus minus terminal, a share bus resistor, and a share bus fuse, wherein said first terminal of said first secondary winding is connected with said share bus plus terminal via said share bus resistor and via said share bus fuse;

a ground terminal, wherein said second terminal of said first secondary winding is connected with said ground terminal;

a small-signal MOSFET including a gate, wherein said second terminal of said second secondary winding is connected with said ground terminal via said small-signal MOSFET;

a first drive input terminal including a first drive voltage, wherein said first drive voltage is coupled into said gate of said power MOSFET;

a second drive input terminal including a second drive voltage, wherein said second drive input is operated as a sample input terminal including a sample voltage, and wherein said sample voltage is coupled into said gate of said small-signal MOSFET; and

a cell telemetry output including a cell telemetry plus terminal and a cell telemetry minus terminal, wherein said first terminal of said second

secondary winding is connected with said cell telemetry plus terminal.

24. The combined DC-DC/flyback cell balancing converter of claim 23, further comprising a capacitor and a resistor, wherein said first drive voltage is coupled into said gate of said power MOSFET via said capacitor and via said resistor.

25. The combined DC-DC/flyback cell balancing converter of claim 23, wherein said sample voltage applied at said second drive input terminal activates a telemetry output voltage between said cell telemetry plus terminal and said cell telemetry minus terminal.

26. The combined DC-DC/flyback cell balancing converter of claim 23, wherein said telemetry output voltage is proportional to said cell voltage applied between said cell plus terminal and said cell minus terminal.

27. The combined DC-DC/flyback cell balancing converter of claim 23, wherein said primary winding and said secondary winding of said transformer are optimized to resonate at switching frequency.

28. The combined DC-DC/flyback cell balancing converter of claim 23, wherein said transformer is constructed using planar winding technology.

29. A cell balancing system for sharing without a common bus, comprising:

a lithium-ion battery including a first cell having a cell plus terminal and a cell minus terminal and a second cell having a cell plus terminal and a cell minus terminal, and wherein a first cell voltage is applied between said cell plus terminal and said cell minus terminal of said first cell, and a second cell voltage is applied between said cell plus terminal and said cell minus terminal of

said second cell;

a first resistor and a second resistor and a transformer including a first winding having a center tap, a first terminal and a second terminal, and a second winding having a center tap, a first terminal and a second terminal, wherein said center tap of said first winding is connected via said first resistor with said cell plus terminal of said first cell, and wherein said center tap of said second winding is connected via said second resistor with said cell plus terminal of said second cell;

a first power MOSFET including a gate, wherein said first terminal of said first winding is connected with said cell minus terminal of said first cell via said first power MOSFET;

a second power MOSFET including a gate, wherein said second terminal of said first winding is connected with said cell minus terminal of said first cell via said second power MOSFET;

a third power MOSFET including a gate, wherein said first terminal of said second winding is connected with said cell minus terminal of said second cell via said third power MOSFET;

a fourth power MOSFET including a gate, wherein said second terminal of said second winding is connected with said cell minus terminal of said second cell via said fourth power MOSFET;

a first drive input terminal including a first drive voltage, wherein said first drive voltage is coupled into said gate of said second power MOSFET and into said gate of said fourth power MOSFET; and

a second drive input terminal including a second drive voltage, wherein said second drive voltage is coupled into said gate of said first power MOSFET and into said gate of said third power MOSFET.

30. The cell balancing system for sharing without a common bus of claim 29, further comprising at least one additional cell of said battery, at least one additional winding of said transformer, at least one additional pair of power

MOSFETs, and at least one additional resistor, wherein the total number of said cells of said battery is equal to the total number of said windings of said transformer, to the total number of said resistors, and to the total number of pairs of power MOSFETs.

31. The cell balancing system for sharing without a common bus of claim 29, wherein each of said cells of said lithium-ion battery is fused for protection against a high fault current due to a component failure.

32. The cell balancing system for sharing without a common bus of claim 29, wherein said battery further includes a plus terminal and a minus terminal, and wherein said plus terminal is connected with a battery charger controller that charges said first cell of said battery to said first cell voltage and said second cell of said battery to said second cell voltage.

33. A method for autonomous cell balancing, comprising the steps of:

providing a battery including a first cell and a second cell;

providing a first bi-directional cell balancing converter and a second bi-directional cell balancing converter;

connecting said first cell balancing converter with said first cell;

connecting said second cell balancing converter with said second cell;

providing a common share bus and connecting said first cell and said second cell with said common share bus;

providing a first drive input and a second drive input, and connecting said first drive input with said first cell balancing converter and said second cell balancing converter, and connecting said second drive input with said first cell balancing converter and said second cell balancing converter; and

balancing the charge of said first cell and said second cell by bilaterally transferring energy between said first cell and said second cell.

34. The method for autonomous cell balancing of claim 33, further comprising the steps of providing at least one additional cell of said battery and at least one additional bi-directional cell balancing converter, wherein the total number of said cells of said battery is equal to the total number of said bi-directional cell balancing converters, and balancing the charge of said cells by bilaterally transferring energy between said cells.

35. The method for autonomous cell balancing of claim 33, further comprising the steps of:

providing a first AND gate and a second AND gate, connecting said first cell balancing converter with said first drive input via said first AND gate, and connecting said first cell balancing converter with said second drive input via said second AND gate;

providing a third AND gate and a fourth AND gate, connecting said second cell balancing converter with said first drive input via said third AND gate, and connecting said second cell balancing converter with said second drive input via said fourth AND gate;

providing a first drive enable input and connecting said first drive enable input with said first AND gate and said second AND gate;

providing a second drive enable input and connecting said second drive enable input with said third AND gate and said fourth AND gate; and

balancing the charge of said first cell and said second cell by bilaterally transferring energy between said first cell and said second cell.